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COMMUNICATIONS

THE AETIOLOGY OF PHLYCTENULAR OPHTHALMIA*

BY

ARNOLD SORSBY

LONDON

(Conclusion)

3.—Personal Investigations

The investigations recorded here were all carried out at White Oak Hospital, a hospital-school of 364 beds under the control of the London County Council, serving children with eye affections requiring prolonged treatment. The upper age limit for admission is sixteen years, and admission is obtained by reference from hospitals, school clinics and school medical inspectors. Though serving London primarily, the hospital is open to children from other parts of the country. Established in 1897 it served originally for the isolation and schooling of children with trachoma in the Poor Law schools of the Metropolis, and having proved singularly successful in eradicating this affection (Sorsby, 1937), the accommodation became available for the treatment of children suffering from other chronic eye disease. Since 1921 an increasing number

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of admissions have concerned such affections as blepharitis, interstitial keratitis and phlyctenular ophthalmia, admissions for trachoma gradually diminishing to insignificant numbers of late years. In the present study, which covers mainly the cases admitted between July 1935 to December 1940, free use was made of statistical data extracted from the records of the writer's predecessors in the office of Visiting Ophthalmologist, the late E. Treacher Collins (1901-1927) and the late M. S. Mayou (1927-1935), and of the interim reports published in 1936 and 1938 (Sorsby, Hamburger and Benham, 1936; Sorsby, Hamburger, Coveney and Nevin, 1938).

(A) *Sex Distribution of Phlyctenular Ophthalmia*

During the sixteen years 1925-1940, 1,392 children with phlyctenular ophthalmia were admitted to the hospital, boys making up 39·1 per cent. and girls 60·9 per cent. of the total number. This distribution differs markedly from that seen in 2,646 cases of other affections (mainly blepharitis and chronic conjunctivitis) in which the corresponding percentages were 53·7 per cent. and 46·3 per cent. Cases of interstitial keratitis were analysed separately, as a heavy preponderance of this affection on girls is a well-established fact. Trachoma cases were likewise treated separately owing to the fact that an artificial sex distinction is liable to be introduced in this group, seeing that the condition is infectious and that on

TABLE VI

Sex incidence of the main groups of affection in children admitted 1925-1940

	Total Number	Boys	Girls	Percentage Distribution	
				Boys	Girls
Phlyctenular Ophthalmia...	1,392	544	848	39·1	60·9
Interstitial Keratitis ...	—	104	160	—	—
Trachoma ...	—	187	223	—	—
Others—mainly Blepharitis and Chronic Conjunctivitis	2,646	1,422	1,224	53·7	46·3

several occasions large numbers from a boys' or girls' residential school were admitted following a minor epidemic in local schools. It is clear from Table VI that whilst there is no marked difference in sex incidence in the total admissions to the hospital, there is a significant preponderance of girls in the phlyctenular group—a finding that agrees with that of other observers.

(B) *The significance of the state of nutrition, pediculosis capitis, focal sepsis, and of protein allergens in phlyctenular ophthalmia*

(1) The state of nutrition.

Records of weight on admission and of progress during treatment are kept in all cases. The statistics department of the London County Council have evaluated these data for an unselected group of children with phlyctenular ophthalmia in comparison to a similar blepharitis group amongst those admitted during 1936 and 1937. The statistical evaluation is shown in the subjoined tables (Tables VIIa and VIIb) from which it is seen that no tangible difference in the state of nutrition is apparent as between the two groups.

TABLE VIIa

Age and sex of patients on admission according to condition treated

Age Groups	1936						1937					
	Blepharitis			Phlyctenular ophthalmia			Blepharitis			Phlyctenular ophthalmia		
	M	F	Total	M	F	Total	M	F	Total	M	F	Total
1-2 years ...	3	2	5	4	2	6	1	4	5	2	7	9
3-4 years ...	5	3	8	5	10	15	6	4	10	3	7	10
5-7 years ...	15	12	27	8	8	16	20	18	38	5	17	22
8-11 years ...	12	17	29	5	6	11	30	20	50	4	10	14
12-15 years...	2	1	3	1	4	5	13	7	20	4	3	7
16 years ...	—	—	—	—	—	—	—	—	—	—	—	—
Total cases...	37	35	72	23	30	53	70	53	123	18	44	62
Mean age (in years and months) ...	7·4	7·11	7·8	6·3	7·1	6·9	9·1	8·3	8·9	8·0	6·8	7·1

TABLE VIIB

Comparison between variation from normal weight for age on admission, normal expected increase in weight, and actual increase in weight at end of first quarter; all figures having been corrected to correspond with the age-group distribution of the 1936—Blepharitis—Males—Group.

	1936				1937			
	Blepharitis		Phlyctenular ophthalmia		Blepharitis		Phlyctenular ophthalmia	
	Males lbs. oz.	Females lbs. oz.	Males lbs. oz.	Females lbs. oz.	Males lbs. oz.	Females lbs. oz.	Males lbs. oz.	Females lbs. oz.
Mean variation from normal weight for age on admission (+ over normal, − under)	−0 9	−0 6	−2 11	−0 7	−0 7	+1 6	+0 15	+0 10
Mean increase in weight at end of the first quarter ...	6 0	6 5	6 1	5 11	5 6	6 1	5 12	7 4
Mean normal expected increase in weight per quarter ...	1 5	1 5	1 5	1 5	1 5	1 5	1 5	1 5

(2) Frequency of pediculosis capitis.

Data were extracted from the registers for the six years 1930-1935, giving a total of 397 cases of phlyctenular ophthalmia and 1,195 cases of various other affections. These data are shown in Table VIII set out according to sex.

TABLE VIII

Incidence of pediculosis capitis in children admitted during 1930-35 inclusive.

	Phlyctenular Ophthalmia			Other Affections		
	Boys	Girls	Total	Boys	Girls	Total
Number admitted	145	252	397	632	563	1,195
Number found affected with pediculosis...	26	77	103	151	178	329
Percentage affected... ...	17·9	30·6	26·0	23·9	31·6	29·2

In both groups it will be seen that girls are more frequently affected with pediculosis, and such differences as were noted in the incidence of pediculosis for boys and girls were in favour of the phlycten group.

(3) Tonsillar sepsis.

During 1936-1938 184 cases of phlyctenular ophthalmia and 414 cases of other affections were examined for evidence of a difference in incidence of naso-pharyngeal sepsis. The findings are presented in Table IX.

TABLE IX

Incidence of tonsillar sepsis in phlyctenular ophthalmia and control groups

	Phlyctenular Ophthalmia	Blepharitis	Interstitial keratitis	Trachoma
Number of children seen ...	184	320	47	47
Recommended for removal of tonsils and adenoids...	14	20	5	3
Antral washouts	4	1	1	2
Tonsillectomy performed before admission ...	21	29	5	8

The 184 cases of phlyctenular ophthalmia, therefore, showed 35 instances of tonsillar sepsis against 70 in the control group of 414 cases, *i.e.*, 19 per cent. and 16·9 per cent. respectively. It should be added that in the tonsils removed in 20 phlyctenular children tubercle bacilli could not be detected. (No serial sections were made.)

(4) Non-bacterial allergens.

In an earlier investigation (Sorsby and Benham, 1936) an account was given of the response obtained with tests to various food and plant allergens in some chronic eye affections. Here it is only necessary to recall that 60 cases of phlyctenular ophthalmia all responded negatively to the following groups of allergens: ungulatae extracts, derivates of milk and egg, house dust, dandruff type, tree pollens, grass pollens, graminaceae, and a composite group consisting of substances like kapok, flock and feathers.

(C) *Evidence of Tuberculous Infection and Tuberculous Disease*

(1) *Tuberculin reaction.*—All children admitted since July 1935 have been tested to tuberculin. In children over 6 years of age the Mantoux test is done as a routine : in those under six the Moro test is applied, Mantoux testing being done where there is some doubt as to the result. In all 592 cases of phlyctenular ophthalmia and 900 cases of blepharitis have been submitted to tuberculin testing. Table X shows the results classified for both these series in age groups.

TABLE X

Results of tuberculin tests in 592 cases of phlyctenular ophthalmia (July, 1935—December, 1940) and 900 cases of blepharitis (July, 1935—August, 1939).

Age in years	Phlyctenular Ophthalmia				Blepharitis			
	Positive		Negative		Positive		Negative	
0-1	0	188=81·7 per cent.	0	42=18·3 per cent.	0	18=8·0 per cent.	0	207=92·0 per cent.
1-2	18		6		2		6	
2-3	40		8		2		18	
3-4	49		10		3		38	
4-5	41		11		0		67	
5-6	40		7		11		78	
6-7	47	313=86·4 per cent.	12	49=13·6 per cent.	9	120=17·7 per cent.	73	555=82·3 per cent.
7-8	38		14		14		97	
8-9	57		4		17		78	
9-10	29		7		17		72	
10-11	46		5		22		70	
11-12	31		4		8		59	
12-13	27		2		14		58	
13-14	20		1		16		34	
14-15	8		0		3		13	
15-16	9		0		0		1	
16-17	1		0		0		0	
	501=84·8 per cent.		91=15·2 per cent.		138=15·3 per cent.		762=84·7 per cent.	

The difference in the results in the two groups is striking. The phlyctenular cases gave a positive incidence of 84·8 per cent. against an incidence of 15·3 per cent. in the blepharitis group. If only the children up to the age of six are considered the incidence of positive results for the blepharitis group is reduced by almost half—8·0 per cent. instead of 15·3 per cent.—but the incidence for the phlycten group is almost the same—81·7 per cent. instead of 84·8 per cent.

The high incidence of positive reaction in the whole of the phlycten group is in itself significant, and this significance is

emphasised by the fact that the incidence is practically identical for both the younger and the older children.

(2) *Radiological examination of the chest.*—From July 1935 until the outbreak of the War all children with phlyctenular ophthalmia were examined radiologically as a routine. The reading of the plates was done in all instances by the late Professor Richard Hamburger. As controls 87 unselected cases of blepharitis and 70 tuberculin positives amongst blepharitis cases were used. The results obtained are summarised in Table XI.

TABLE XI

Radiological chest findings in 510 cases of phlyctenular ophthalmia (July, 1935—August, 1939) compared with findings in 87 unselected cases of blepharitis and 70 tuberculin positive cases in a series of 429 children with blepharitis.

	Total Number	Tuberculosis of chest as shown by X-rays	In this number are included cases in which activity is to be suspected	Indefinite X-ray findings	Definitely negative
Phlyctenular Ophthalmia ...	510	368=72·2 per cent.	100=19·6 per cent.	82=16·1 per cent.	60=11·7 per cent.
Blepharitis (a) unselected ...	87	14=16·1 per cent.	3=3·4 per cent.	23=26·4 per cent.	50=57·5 per cent.
(b) Tuberculin positives in a series of 429	70	36=51·4 per cent.	4=5·7 per cent.	28=40·0 per cent.	6=8·6 per cent.

The high incidence of positive radiological findings in the phlycten group as compared to 87 unselected cases of blepharitis stresses the significance of a tuberculous lesion in the aetiology of phlyctenular ophthalmia, whilst the significance of positive tuberculin reactions in phlyctenular children is emphasised by the considerable percentage of positive radiological findings in the 70 blepharitis cases who reacted positively to tuberculin. As a further comparison of the phlycten group with the blepharitis group, the following computation, given with some reserve, is perhaps admissible: if it assumed that, in the group of 429 blepharitis cases, the 359 who responded negatively to tuberculin show no radiological evidence of chest tuberculosis, then the incidence of radiological tuberculosis for the whole blepharitis group is 8·4 per cent. including 0·9 per cent. in which activity is to be suspected, as against 72·2 per cent. and 19·0 per cent. respectively for the phlycten group of 510 cases.

(3) *Clinical tuberculosis.*—A number of cases of tuberculous disease sufficiently definite to be notified were observed among

the 592 children with phlyctenular ophthalmia admitted between July 1935 and December 1940. The diagnoses were made by either the late Dr. Hamburger or Dr. S. A. Owen, the consulting paediatrist to the hospital, and in most instances agreed upon by both these physicians. No case of clinical tuberculosis was seen in the blepharitis group. The distribution of lesions is shown in the subjoined table.

TABLE XII

Clinical tuberculosis observed in 592 cases of phlyctenular ophthalmia and 900 cases of blepharitis (July, 1935—December, 1940)

	Phlyctenular Ophthalmia	Blepharitis
Chest	26	0
Cervical glands ...	6	0
Spine	2	0
Hip	2	0
Elbow	1	0
Meninges (fatal)...	1	0
	38=6·4 per cent.	0

(4) *Family history of tuberculosis.*—A series of 263 successive cases of phlyctenular ophthalmia were submitted for information on the family history to the Tuberculosis department of the London County Council, who in turn sought this information from the medical officers of health of the various London boroughs. The necessary data were obtained from the tuberculosis registers of the boroughs supplemented in many cases by home visits. Table XIII summarises the returns obtained.

TABLE XIII

Family history of tuberculosis in 263 cases of phlyctenular ophthalmia (June, 1937—August, 1939)

Number of cases investigated	Family history negative	Family history positive	
		with contact of a case of tuberculosis	without contact of a case of tuberculosis
263	187=71·1 per cent.	59=22·4 per cent.	17=6·5 per cent.
		76=28·9 per cent.	

No comparative data for the blepharitis children were established and only indirect evidence on the frequency of positive family histories in the normal school child population is available. Bentley (1931) computed that in 1929 the incidence of a notified case of tuberculosis in the families of the school child population was 3·7 per cent. It is probably lower now, but in any case an

incidence of positive family history of tuberculosis about 8 times as heavy for the phlycten case in comparison to the normal child is suggestive.

(5) *Sedimentation rate.*—The sedimentation rate was determined in 254 cases of phlyctenular ophthalmia and in a control group of 256 cases of blepharitis. Generally speaking the quiescent phlyctenular cases showed normal rates, whilst the active phlyctenular cases showed a high rate (over 10mm., 1 hr.), as can be seen from the subjoined table.

TABLE XIV

Sedimentation rate in 254 cases of phlyctenular ophthalmia and in a control group of 256 cases of blepharitis

Phlyctenular ophthalmia: total number examined: 254 { 124 active / 130 quiescent

	Active Cases	Quiescent Cases
Sedimentation rate normal (up to 10 mm. 1 hr.)...	25 (20·2 per cent.)	121 (93.1 per cent.)
Sedimentation rate raised (over 10 mm. 1 hr.)...	99 (79·8 per cent.)	9 (6·9 per cent.)

Blepharitis: Total number examined 256
Sedimentation rate normal ... ... 219 = 85·5 per cent.
Sedimentation rate raised ... ... 37 = 14·5 per cent.

No detailed investigations have been carried out on the course of sedimentation rates during the progress of the affection. The fact that quiescent cases show predominantly normal rates does in itself suggest that a return to normal occurs with progress towards subsidence. This is borne out by the few cases on which repeated observations were made. As examples the following may be given:

(1) Rate at the height of activity, 20mm., 1 hr.; two months later the eyes were quiet and rate had declined to 6mm.

(2) Rate at the height of activity 23mm., 1 hr.; six months later, though the eyes were quiet the rate was still 15mm., but this declined to 8 within another fortnight.

An increase in the rate from 17mm. to 22mm. within six weeks has been observed whilst the child was under treatment. The phlyctenular lesion had remained active during that time.

(6) *Absence of tubercle bacilli in stomach washings and in extirpated tonsils.*

(*a*) Stomach washings.

Fifty of the younger children under the age of 8 years with phlyctenular keratitis—some showing negative Mantoux reactions—had stomach lavage done, and the washings were examined, both bacteriologically and by guinea-pig inoculation, for the presence of the tubercle bacillus. All these 50 cases, as also 8 control cases of blepharitis were negative.

(*b*) As already noted, a search for tubercle bacilli in excised tonsils in 20 cases of phlyctenular ophthalmia gave negative results. (Serial sections were not made.)

(7) *The after-history as to clinical tuberculosis of 754 cases of phlyctenular ophthalmia and comparison with 526 cases of blepharitis and 498 cases of conjunctivitis treated at White Oak Hospital 1921-1931.*—The names of children admitted for phlyctenular ophthalmia for the 11 years between 1921-1931, and who at the time of admission had London addresses, were submitted in 1936-1937 to the Tuberculosis Department of the London County Council, who have a record of all notified cases of tuberculosis in their administrative area. In this way information was obtained on the after-history as to tuberculosis in this group of children. For controls the names of 526 cases of blepharitis and 498 cases of chronic conjunctivitis were also submitted. The subjoined tables summarise the data obtained.

TABLE XVa

Incidence of notified tuberculosis in 754 phlyctenular cases admitted to White Oak Hospital, 1921-1931

	Number of cases followed up	Number of cases showing tuberculosis	Age on admission and sex	Type of tuberculosis	Time noted in relation to admission
1921	75	2	(1) 6 M	Lupus of skin and mucosa of nose	6 years later
			(2) 9 F	Lungs	3 years later
1922	87	3	(1) 12 F	Lungs	On admission. Died 16 months later
			(2) 12 F	Lungs	6 months before admission; had been under treatment for eye condition since age of 4
			(3) 12 F	Lungs	4 years later. Died 2 years subsequently
1923	63	1	15 F	Sclerokeratitis	4 years later
1924	51	2	(1) 7 F	Renal	11 years later
			(2) 11 F	Pleura	3 years before
1925	74	5	(1) 12 M	(a) Ankle	(a) 8 years before (amputation, 1916)
				(b) Lungs	(b) 4 years before
			(2) 5 F	Spine	1 year later
			(3) 7 F	Lungs	9 years later
			(4) 11 F	Cervical glands	1 year later
			(5) 3 M	Spine	On admission

TABLE XVA—*continued*

	Number of cases followed up	Number of cases showing tuberculosis	Age on admission and sex	Type of tuberculosis	Time noted in relation to admission
1926	71	5	(1) 3 M	Lungs	9 years later
			(2) 13 M	Lungs	On admission
			(3) 4 F	Lupus of Cheek	1 year later
			(4) 10 F	(a) Kidney	(a) 8 years later
				(b) Cystitis	(b) 10 years later
				(c) Lungs	(c) 10 years later
			(5) 12 M	Lungs	6 years later. Died 2 years subsequently
1927	69	4	(1) 6 F	Knee	Noted at Swanley
			(2) 2 F	(a) Lungs	(a) 2 years later
				(b) Hip	(b) 7 years later
			(3) 5 F	Cervical Adenitis	5 years later
			(4) 12 M	Lungs	4 years later
1928	79	5	(1) 12 M	Os calcis	1 year later
			(2) 11 F	Lungs	5 years later (Died within a year)
			(3) 5 F	Bronchial adenitis	Before admission
			(4) 7 M	Cervical Adenitis	4 years before
			(5) 2 F	Lungs	6 years later. Died the same year
1929	60	6	(1) 11 M	Ankle	2 years before
			(2) 3 F	Cervical Adenitis	3 years later
			(3) 4 F	Lungs	2 years before (reported cured 1935)
			(4) 4 F	Adenitis: neck, axilla and groin	3 years later
			(5) 9 F	Cervical Adenitis ? knee (father and mother died of tuberculosis)	2 years later
			(6) 9 M	Cervical Adenitis	6 years later
1930	63	4	(1) 6 F	Tuberculous abscess, neck	4 years later
			(2) 3 F	Spine	At White Oak
			(3) 10 M	Lungs	6 months before admission
			(4) 8 M	Lungs	6 years later
1931	62	3	(1) 8 M	Cervical glands	3 years later
			(2) 11 M	Lungs	1 year later
			(3) 13 F	Lungs	4 years later. Died 2 years subsequently
	754	40=5·3 per cent.			

TABLE XVB

Incidence of notified tuberculosis in 526 cases of Blepharitis admitted to White Oak Hospital, 1921-1931

	Number of cases followed up	Number of cases of notified tuberculosis	Age on admission and sex	Type of tuberculosis	Time noted in relation to admission
1921	46	1	(1) 7 F	Lungs	13 years later. Died the same year
1922	58	2	(1) 13 M (2) 9 M	Lungs Lungs	12 years later 13 years later
1923	43	0	—	—	—
1924	39	0	—	—	—
1925	31	2	(1) 5 M (2) 11 F	Adenitis Lungs	3 years later 11 years later
1926	48	0	—	—	—
1927	46	0	—	—	—
1928	46	0	—	—	—
1929	56	0	—	—	—
1930	69	0	—	—	—
1931	44	0	—	—	—
	526	5=0·95 per cent.			

TABLE XVC

Incidence of notified tuberculosis in 498 cases of conjunctivitis admitted to White Oak Hospital 1921-31

	Number of cases followed up	Number of cases of notified tuberculosis	Age on admission and sex	Type of tuberculosis	Time noted in relation to admission
1921	48	1	10 F	Lungs	10 years later
1922	41	0	—	—	—
1923	39	0	—	—	—
1924	60	0	—	—	—

TABLE XVc—*continued*

	Number of cases followed up	Number of cases of notified tuberculosis	Age on admission and sex	Type of tuberculosis	Time noted in relation to admission
1925	58	0	—	—	—
1926	112	0	—	—	—
1927	40	1	10 F	Lungs	9 years later
1928	27	0	—	—	—
1929	24	1	9 M	Tarsus	3 years before. (Still under supervision, 1937)
1930	31	0	—	—	—
1931	18	0	—	—	—
	498	3=0·60 per cent.			

The difference in the incidence of notifiable tuberculosis in the phlycten group and in the two control groups appears to be significant: against an incidence of 5·3 per cent. (40 cases out of 754) in the phlycten group, the blepharitis group gave 0·95 per cent. (5 cases out of 526) and the conjunctivitis group 0·60 per cent. (3 cases out of 498), or 0·8 per cent. if the two control groups are treated as one. The incidence of tuberculosis in the phlycten group followed up over a period of six to sixteen years is therefore about seven times as high as in the control group. The type of tuberculosis seen in these erstwhile phlycten cases is frequently of considerable gravity. The distribution of lesions in these forty cases was: tuberculosis of lungs, 18; bone and joints, 9; glands, 9; kidney, 2; skin and mucosa, 2; eye, pleura, bladder and abscess of neck, 1 each. It is also worth noting that against 1 (0·1 per cent.) death from tuberculosis in the control group there were 6 (0·8 per cent.) in the phlycten group, and that whilst the fatality in the control group occurred 13 years after admission for blepharitis, the deaths in the phlycten group all occurred within 2 years (in two instances within a year and, in four, within two years).

4.—Discussion

(1) *The nature of the phlycten.*—Valuable as it is the experimental work on phlyctenular ophthalmia has not solved the problem of its aetiology. It has eliminated the possibility of the

phlycten being a reaction of the conjunctiva and cornea to microbial infection and it has stressed the significance of a sensitised soil. Beyond that, the evidence gives no guidance to the phlyctenulosis as a clinical problem. The experimental evidence fits in well with the findings that the phlycten is histologically and biologically sterile and unspecific in structure. The core of epithelioid cells amongst which are interspersed some polymorphs is the picture of a non-specific allergic reaction. It is true that the phlycten may show considerable histological variation: giant cells (but no caseation) may be present but this only indicates chronicity; a considerable mononuclear and polymorph reaction may be seen but this occurs with ulceration and secondary infection of the ulcerated phlycten.

The non-specificity of the phlyctenular reaction is clearly reflected in the clinical findings, which, whilst indicating the occurrence of the phlycten in a great variety of affections leave room for the clinical entity which goes under the name of phlyctenular ophthalmia. It is on the aetiology of this clinical entity that no clear guidance is given by experimental and histological studies beyond the suggestion that this must be sought in the interaction of an exogenous or endogenous exciting factor with a sensitised soil. The problem still remains whether clinically the sensitisation is always of the same character and whether the exciting agent must be specific or non-specific. The solution to this clinical problem lies largely, if not entirely, in clinical studies.

(2) *Possible aetiological factors.*—If the phlycten is regarded as a non-specific allergic reaction, there is no *a priori* reason why most of the numerous causal factors that have been suggested in phlyctenular ophthalmia could not be incriminated on theoretical grounds. On such grounds, anomalies in the carbohydrate metabolism could well be the cause of phlyctenulosis, in view of the work on the hapten particle of organisms as a source of sensitisation; given such a sensitisation from infection by a hapten-bearing organism, carbohydrate abuse might precipitate a phlyctenular reaction. Focal sepsis and non-bacterial allergy could equally be causes and pediculosis might well be a cause if it is assumed that a toxin is first absorbed into the system. In all such assumptions, specificity is taken for granted, though there is some experimental evidence that the exciting agent need not necessarily be specific. If it is granted that, with a sensitised soil, a non-specific exciting factor is effective, the theoretical case for faulty carbohydrate metabolism, focal sepsis and pediculosis becomes even less open to criticism. But all these discussions deal with hypotheses. The task remains, in the first place, to establish the nature of the sensitisation seen in patients with phlyctenulosis.

(3) *The nature of the sensitisation seen in phlyctenulosis.*—

From the review of the literature and the evidence brought out in the personal investigations, it is clear that whilst malnutrition, pediculosis and focal sepsis and non-bacterial allergy are seen in cases of phlyctenular ophthalmia, there is no tangible evidence that these conditions occur with greater frequency in such patients compared to the normal child population, and no evidence whatever that any one of these factors could explain the occurrence of phlyctenulosis in the mass. The available data do, however, indicate tuberculous infection as a dominant feature. Briefly this evidence may be summarised as:

(i) Positive tuberculin reaction: this was noted in 752 (78·3 per cent.) out of 960 children under the age of 6 years reported in the literature and in 188 (81·7 per cent.) of a series of 230 reported in the present study.

(ii) Radiological evidence of tuberculosis: a heavy incidence is reported by many observers. In the present series it was found in 72·2 per cent. (368 cases out of 510).

(iii) Clinical tuberculosis: noted in 6·4 per cent. (38 cases out of 592) in the present series against no cases in a larger control group.

(iv) Family history of tuberculosis: observed in 28·9 per cent. in a series of 263 cases.

(v) Sedimentation rate: in 124 cases of active phlyctenular ophthalmia, 99 (79·8 per cent.) showed a rate of over 10mm., 1 hr.

(vi) After history of children with phlyctenular ophthalmia: in a series of 367 cases Ajo found the subsequent mortality rate from tuberculosis practically twice that of the normal population; tuberculous disease had developed in 39 out of 100 (somewhat selected) cases, who could be examined clinically. In the present study 754 cases gave 40 cases (5·3 per cent.) of tuberculous disease against 8 cases (0·8 per cent.) in 1,024 controls; there was a mortality rate from tuberculosis of 0·8 per cent. in the phlycten group against 0·1 per cent. in the control group.

The personal experience of F. Hamburger (1923) is rather illuminating. His eldest son had become infected with tuberculosis at the age of 15 years. For five months the four remaining children had shown no evidence of infection as revealed by repeated tuberculin tests. Then, within the space of two days, three of these four children developed transient conjunctivitis, the youngest showing a typical phlyctenular reaction (with two subsequent recurrences). Tuberculin reactions now proved positive in all the four children. Hamburger traced the source of infection to a maid who had been employed in the household for two years and had been found healthy when first engaged. She was now suffering from open pulmonary tuberculosis.

The trend of the following case history from the records of White Oak Hospital is not an isolated instance. A boy, aged 1 year, was admitted for active phlyctenular ophthalmia. The Moro test was positive. Radiographs showed marked right hilar shadows and a wide mediastinal shadow, suggestive of tuberculous infection of the right middle and lower lobes. Clinically, the lungs gave an impaired note over the right paravertebral region. (Dr. Helen Mackay.) The child did not do well and was taken away by the parents against advice, after seven months' stay at the hospital. The family history had been negative. The child was readmitted seven months later with a severe relapse. In the meantime the mother had been notified as a case of pulmonary tuberculosis.

If it is accepted that tuberculous sensitisation is the underlying condition necessary for the development of phlyctenulosis, the question still remains what are the factors necessary to excite the reaction. Not all tuberculous-infected children develop phlyctenulae, and phlyctenular ophthalmia shows a difference in sex incidence and a seasonal variation which cannot be explained without a fuller understanding of both the basic sensitisation and the added exciting factors.

(4) *Seasonal variation and sex incidence in relation to the aetiology of phlyctenulosis.*—Seasonal variation in the incidence of phlyctenulosis with its peak in spring led to the suggestion that sunlight acts as an exciting agent and to the contrary supposition that the phlycten is the end-result of months of lack of sunshine. Rohrschneider (1935) has sought to explain the spring incidence by establishing a relationship between the month of maximum incidence of phlyctenulosis in various centres to the amount of sunshine available in these different centres at the particular time. He concluded that the highest incidence of phlyctenulosis occurs when the sun is at 45°, and holds that the amount of ultra-violet radiation present has some bearing on the outbreak of phlyctenulosis. A detailed study by Urbanek and Roschkott (1939) of meteorological conditions for Vienna in relation to the monthly incidence of phlyctenulosis was rather inconclusive. They found that over a number of years, when the peak incidence of phlyctenulosis was in March, there was sunny weather during that month; with a cold March the maximum incidence of phlyctenulosis came later in the year. Maximum incidence did not, however, necessarily occur with warm months; in 1928-1932 April was exceptionally sunny, yet the maximum incidence of phlyctenulosis did not occur till May. The secondary peak in incidence observable in autumn was sometimes, but not invariably, associated with a warm autumn month.

The spring peak may perhaps also be connected with the accumulating vitamin A deficiency during the winter months. The

absence of fresh vegetables during winter and the low vitamin A content of milk during the winter months may lead to a lowering of the vitamin A of the blood—a possibility that is suggested by the finding of Frominopoulos that some of his patients had a distinctly subnormal vitamin A content.

Whatever be the explanation, the greater incidence of phlyctenulosis during spring has clinical parallels, both, with tuberculin reactions, and erythema nodosum. The incidence of positive tuberculin reactions is greater in spring and reactions are apt to be more marked during those months (lit. in Peyer, 1921). Erythema nodosum—generally regarded as a tuberculous manifestation—has a seasonal distribution similar to phlyctenular ophthalmia (lit. in Walgren, 1930) and this is of interest both in relation to the more ready reaction of the skin to tuberculin during spring and the readier appearance of phlyctenulae during these months.

The *sex incidence* of phlyctenulosis with the heavier affection of girls is probably an expression of both a greater incidence of tuberculous sensitisation and a greater exposure to possible exciting factors. There is some evidence that tuberculous infection is more frequent in girls.

In London Dow and Lloyd (1931) carried out Mantoux reactions in 576 boys and 427 girls aged 0-15 years. The percentage of positive reactors was consistently higher for girls: 46·1 per cent. against 40·8 per cent. for the two groups as a whole, and for the age groups 0-5 years, 5-10 years, 10-15 years, the incidence was respectively 25·0 per cent., 41·7 per cent. and 60 per cent. for girls against 21·8 per cent., 37·1 per cent. and 56·8 per cent. for boys. Data for Paris are given by Nobécourt and Briskas (1936); 2,093 boys aged 6-15 years and 1,672 girls of the same ages were tested to tuberculin between 1921 and 1935. The age groups 6-9 gave 49·1 per cent. of positive reactors in girls against 43 per cent. in boys; the age groups 10-15 gave corresponding incidences of 67·5 per cent. and 63·3 per cent. A heavier incidence for girls is also reported for New York by Drolet (1934). In a group of 6,080 children aged 0-15 years he found 14·9 per cent. positive reactors among girls, against 12.7 per cent. for boys. The higher incidence for girls was shown consistently in the subsidiary age groups 0-5, 5-10, 10-15 years, the respective percentages for girls being 10, 20·9 and 30·5 against 8·8, 17·4 and 28·1 for boys. In San Francisco Dickey and Seitz (1931) found for children aged 1-14 years in 1925, girls gave 24·3 per cent. positive reactors (in a series of 1,601) and boys 22·9 per cent. (in a series of 1,899). At Philadelphia Hetherington, McPhedran, Landis and Opie (1929) in a series of 2,029 girls aged 3-20 years found 75·1 per cent. positive reactors, against 72 per cent. in a corresponding series of 2,078 boys. Further data of a similar kind are available but it must be pointed

out that evidence of an opposite character has also been reported, and there is apparently no agreement on this issue.

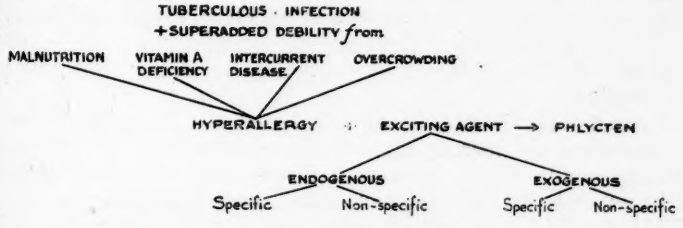
The greater frequency of phlyctenulosis in girls may be due to a greater frequency of tuberculous infections in them, or to other factors such as the greater likelihood of young girls of tuberculous households being more confined to the home than boys and thus more exposed to superinfection. The greater frequency of pediculosis in girls may also be a factor—if it is accepted that pediculosis is an exciting agent of phlyctenulosis in a sensitised soil. (It is also conceivable that pediculosis in a tuberculous household may produce the necessary breach in the skin for tuberculous infection to occur.) Finally, it is possible that girls react more readily to any foreign protein, as Weekers (1929) suggested on a study by Dujardin who reported that 50 per cent. of women against only 10 per cent. of men give strong reactions to the intradermal injection of 2 c.c. horse serum.

(5) *The outbreak of phlyctenulosis.*—Granted that tuberculous infection is the basic condition for the occurrence of phlyctenulosis, it must be admitted that little is known of the actual mechanism which precipitates the phlycten. There is some validity in the argument that the seasonal variation and the difference in sex incidence of phlyctenulosis are primarily aspects of tuberculous infection rather than of the phlycten problem. Again, the age of incidence of phlyctenulosis may be regarded as evidence not of a special predilection that children have for phlyctenulae, but as evidence that the phlycten is a manifestation of the stage of tuberculous invasion rather than of the later development of tuberculous localisation at definite organs (second and third stages in Ranke's classification.) All such conceptions lead to a study of the reaction of the body to tuberculous infection and the mass of experimental and clinical observations on this aspect has, as yet, not been reduced to clear cut fundamentals. The fact that, in established tuberculous disease, the Mantoux reaction is not infrequently negative and that, in the earlier stage of invasion, tuberculin tests are almost always positive, leads to the suggestion that the body (or at any rate the skin) is hyperallergic in the invasive stage. On such a view phlyctenulosis is an expression not only of tuberculous infection but of tuberculous hyperallergy. The allergic states of the body are, of course, not static phenomena. They constantly vary in intensity and an hyperallergic phase may be precipitated by measles, or any other debilitating condition. One aspect of the mechanism of the production of the phlycten may therefore be tuberculous infection, concurrent with an hyperallergic phase. Poverty, malnutrition and overcrowding, so often associated with tuberculosis, may be the factors largely responsible

for the development of the special degree of hyperallergy postulated as necessary for the appearance of a phlycten. On the experimental side Kuniya (1935) has advanced some evidence showing that the ease with which phlyctenulae can be excited in a tuberculous-sensitised animal varies directly with the degree of phagocytosis against the tubercle bacillus.

The nature of the factors that precipitate a phlycten in the hyperallergic is unknown. If it is believed that only a specific agent will precipitate a phlycten, then this must be sought in liberated tubercle bacilli or their products within the child's body, or in tubercle bacilli in the child's environment. If non-specific irritants are capable of inducing a phlycten then any of the endless exogenous factors that have been suggested as responsible for phlyctenulosis may be involved. On this issue there is no evidence on which to base any valid conclusions.

The subjoined diagram is given with considerable reserve and is not to be taken as a summary of established facts but as an indication of the likely mechanism in the production of phlyctenulosis.



(6) *The significance of phlyctenulosis.*

(*a*) Aetiological considerations.

If it is urged that the tuberculous nature of an affection is proved only by the demonstration of tubercle bacilli in the lesion, all the available evidence clearly excludes phlyctenular ophthalmia. The affection is also excluded if there is insistence on the demonstration of tubercle bacilli elsewhere in the body apart from the actual phlycten, for blood cultures have given negative results (other than those obtained by the Loewenstein technique); stomach washings, as reported in the present investigations, have also been negative, and the evidence for tubercle bacilli in the tonsils is not extensive. The case for the tuberculous nature of phlyctenular ophthalmia rests on less direct evidence.

That evidence—and it is strikingly similar to that advanced for the tuberculous nature of erythema nodosum—has been questioned, not indeed as to its accuracy, but on the interpretation which has been given to it. It is argued that positive tuberculin tests indicate a non-specific allergic skin reaction, and Loddoni has shown that

acute phlycten cases respond positively to horse serum as well as to tuberculin. Such an objection overlooks the facts that the response to tuberculin is not transient (as is a positive result to horse serum) but a permanent characteristic of the patient, and that the positive skin reaction is not an isolated finding in such a patient. The heavy incidence of radiologically demonstrable tuberculosis cannot be overlooked; nor can the considerable incidence of clinical tuberculosis in the course of phlyctenular ophthalmia be dismissed. The after history of phlycten patients revealing not only a heavy incidence of tuberculosis, but also a considerable mortality, cannot be without significance.

Those who question the tuberculous nature of phlyctenular ophthalmia stress the fact that this affection is rare in sanatoria. It may be doubted whether this is strictly true, for many cases of phlyctenular ophthalmia are transient in character and easily overlooked. Moreover, evidence of past phlyctenulosis in patients with established tuberculous disease is not infrequent. It may be granted that phlyctenulosis is not commonly seen in adults with tuberculosis, but this only indicates that the phlycten is not a feature of that stage of tuberculosis which is manifested by the localisation of the disease into specific organs, but of the earlier stage of invasion which is accompanied by allergy induced by the invasion.

In strict logic it may be admitted that the phlycten is not a manifestation of tuberculosis, but the evidence that it is a manifestation of the altered state of the body following the invasion of the tubercle bacillus appears to be incontrovertible.

This conclusion is subject to an important qualification. In some 10-15 per cent. of cases there is no evidence for tuberculous infection. These cases illustrate the non-specificity of the phlycten reaction and experience at White Oak Hospital has shown that non-tuberculous phlyctenular ophthalmia tends to run a distinct clinical course. The disease is much more protracted, the response to treatment is poor, and there is a marked tendency towards massive scarring of the cornea which shows facette-formation rather than the localised opacities seen in the more usual type.

(*b*) Prognostic considerations.

Phlyctenular ophthalmia is not a minor malady, either from the ophthalmological, or from the general aspect. Though not an important cause of blindness, it may result in considerable impairment of vision. But its general significance overshadows the purely ophthalmological aspects. At its best the occurrence of phlyctenular ophthalmia in a child indicates tuberculous infection, and its significance is that of a spontaneous Calmette reaction; in a young child this in itself is a serious matter. The phlycten is, however, more than a spontaneous tuberculin reaction.

The raised sedimentation rate that is seen in active phlyctenular ophthalmia is in itself suggestive. It is an open question whether this raised rate reflects an underlying general disturbance of which the phlycten is the expression, or whether the phlycten represents the local point at which a superinfection has occurred. Either reading carries considerable prognostic significance. It is true that most cases of tuberculous infection, whether accompanied by phlyctenulae or not, subside without developing into clinical tuberculosis, but the occurrence of a phlycten seems to indicate a check to that favourable outcome. This is also brought out by the two studies available on the after-history of large series of cases of phlyctenular ophthalmia. Both Ajo's series and the study reported here indicate a heavy incidence of tuberculous disease in later life with a not inconsiderable mortality. There is certainly no evidence for believing, as is generally done in the case of tuberculous adenitis in children, that the affection is protective against the development of severe tuberculosis in adult life. It would therefore appear that it is not enough to regard the child with phlyctenular ophthalmia as infected with tuberculosis; there is strong presumptive evidence that the child must also be regarded as hyperallergic and devoid of a proportionate increase in immunity. The phlycten is thus more than a sign of tuberculous infection; it is a danger signal of possible tuberculous disease. The frequent relapses seen in the course of phlyctenular ophthalmia are not so much an ophthalmological problem as part of the larger issue which deals with the factors that determine whether a tuberculous infection will become quiescent or evolve into tuberculous disease.

(7) *Outstanding problems.*—The conception of phlyctenulosis as a manifestation of an hyperallergic phase in tuberculous infection requires clarification, and the problem resolves itself into a study of objective evidence for such a phase. A more detailed investigation of sedimentation rates in phlyctenulosis may bring further light on the underlying general reactions. Obscure as these aspects of phlyctenulosis are, there is much greater obscurity on the exciting factors operative on the sensitised soil. The fundamental problem whether such factors are largely endogenous or exogenous has hardly been explored at all. No valid interpretation of photophobia—a striking feature in phlyctenulosis—appears to be available, nor is there conclusive evidence that the heavier incidence of phlyctenulosis in girls is indeed due to a heavier incidence of tuberculous infection in them.

The final and most fundamental question is whether the phlycten is to be regarded as a protective reaction by which the body eliminates the toxins of the tubercle bacillus and of other breakdown products foreign to the body, or whether it is the incidental manifestation of tissue damage produced by tuberculous infection under suitable conditions.

Summary

I.

A review of the literature reveals that:

1. The phlycten is not a specific lesion. It has been described in conjunctival and corneal reactions in a variety of aetiologically distinct conditions. The mass of phlyctenular ophthalmia does, however, constitute a clear-cut clinical entity.

2. Excepting the period 1914-18 and its aftermath when there was a sharp increase in the incidence of the affection on the Continent, phlyctenular ophthalmia has become much less frequent during the past 40 years.

3. The disease falls heavily on childhood but young adults are frequently affected.

4. Girls are more frequently affected than boys, the ratio being about 6 to 4.

5. There is a seasonal variation in incidence, the affection being commonest in spring.

6. There is no valid evidence incriminating nutritional deficiencies, focal sepsis, pediculosis and endocrine disturbances as causal factors.

7. A mass of evidence points to tuberculous infection as the underlying cause of phlyctenular ophthalmia. This evidence consists of (1) a high incidence of positive tuberculin reactions; (2) a high incidence of radiologically demonstrable tuberculous chest lesions; (3) the finding of tubercle bacilli in the tonsils of phlycten patients; (4) a considerable incidence of a personal history of tuberculous disease; (5) a considerable incidence of a family history of tuberculosis; (6) an unfavourable after-history in many cases; (7) the clinical similarity of phlyctenular ophthalmia to the sequence of the ophthalmo-reaction of Calmette in tuberculous patients; (8) a significant incidence of previous phlyctenulosis in adults suffering from tuberculosis.

8. Experimental studies implicate a sensitised soil as well as an exciting factor in the development of the phlycten. Sensitisation can be induced by a variety of agents, tuberculous infection being one. The exciting factor is best, but not necessarily the specific sensitising agent.

II.

An analysis was made of the data on cases of phlyctenular ophthalmia treated at White Oak Hospital during 1921-1940, and detailed investigations are recorded on the cases treated between June 1935 and December 1940. Each point investigated was

checked in control material obtained largely from the children treated for blepharitis at that hospital. These data show that:

1. The heavier incidence of the affection on girls is confirmed.
2. There is no evidence that malnutrition, focal sepsis and pediculosis are seen more frequently in phlyctenular ophthalmia than in blepharitis.
3. Non-bacterial allergy is not a causal factor in phlyctenulosis.
4. Positive tuberculin reactions were obtained in 84·8 per cent. of all phlycten cases and in 81·7 per cent. in phlycten cases under the age of 6 years. The corresponding incidences in blepharitis cases were 15·3 per cent. and 8·0 per cent.
5. Radiological evidence of tuberculosis was present in 72·2 per cent. of phlycten cases against 8·4-16·1 per cent. for controls.
6. Clinical tuberculosis was seen in 6·4 per cent. of phlycten cases against no cases in the control series.
7. A family history of tuberculosis was present in 28·9 per cent. of phlycten cases against a computed incidence of 3·7 per cent. for the normal school child population.
8. The sedimentation rate was raised in 79·8 per cent. of cases with active phlyctenular ophthalmia. Quiescent phlyctenular ophthalmia and blepharitis gave normal rates.
9. Tubercle bacilli could not be recovered in the stomach washings of 50 cases, nor in the excised tonsils of 20 others.
10. The after history of cases treated between 1921 and 1931 revealed an incidence of 5·3 per cent. of clinical tuberculosis and a mortality rate of 0·8 per cent. in the phlycten against 0·8 per cent. and 0·1 per cent. respectively for the controls.

III.

It is concluded that phlyctenular ophthalmia is a manifestation, not of tuberculous disease, but of tuberculous infection, the phlycten making its appearance only when a hyperallergic phase is present and there is a suitable (? specific) exciting factor of endogenous or exogenous origin. It is suggested that the age distribution, sex-incidence and seasonal variation seen in phlyctenulosis are best explained on the assumption that the affection is tuberculous in character. The prognostic significance of the phlycten is graver than that of a positive tuberculin reaction in a child; this is borne out by the subsequent incidence of tuberculosis and mortality from it in children previously affected with phlyctenulosis.

My thanks are due to my colleagues on the staff of White Oak Hospital. The late Professor Richard Hamburger undertook the arduous task of supervising the radiological investigations and of

reading the radiographs. He and Dr. S. A. Owen made themselves responsible for the diagnoses of general affections in the children studied. Mr. S. A. Beard kindly reported on naso-pharyngeal sepsis. Dr. J. E. McCartney, Director of Research and Pathological Services of the London County Council, carried out the laborious inoculation experiments on stomach washings. The resident medical staff at the hospital and the matron and nursing staff have facilitated the work by their ready co-operation. The Departments for Special Hospitals, for Statistics and for Tuberculosis of the London County Council have given every possible help, and my thanks are specially due to Dr. J. A. H. Brincker, Dr. Andrew Topping and Dr. F. J. Bentley. To Mr. L. H. Savin I am indebted for valuable criticisms during the course of this investigation.

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INVOLUNTARY CONVERGENCE, EYESTRAIN AND SQUINT

BY

N. A. STUTTERHEIM

JOHANNESBURG

IN ophthalmology there are two schools of thought, the physiological and the physical or mechanical school. Thus Williamson-Noble[1], dealing with my method of treating eyestrain, states: "curiously enough, Stutterheim designates the condition which his exercises are designed to improve as "involuntary convergence," whereas, as you will shortly see, it is the ability to perform the act voluntarily which is of real importance." He then describes how he has changed my technique of treatment into one with the rotary prism and the synoptophore, giving the "job" to the orthoptic trainer rather than doing it himself. This is the mechanical outlook.

On the other hand Zeeman[2], collaborator of Brouwer[3] at the Institute for Brain Physiology, in a press note on my work "Eyestrain and Convergence"[4], states concerning my method: "It aims at harmonic training and widening of the important function of convergence, which is correctly called "involuntary."

By Elschnig[5] convergence movements are called fusion movements. The "fusion movements" Elschnig refers to are the movements of convergence, as his description shows. He writes: "These movements are eye movements that alter the position of the eyes in such a way that the visual lines at every moment meet in the object of fixation. In normal binocular vision they occur *unconsciously* and *involuntarily*." (The italics are mine.)

The range of these movements Elschnig gives as the sum of the strongest abducing prism and the strongest adducing prism that can be overcome by binocular fixation of a very far point without diplopia occurring. The normal abduction range (negative convergence) Elschnig gives as about 8 dioptres of prism, the normal adduction range (convergence) he gives as about 50 dioptres of prism.

Duane[6] measures a (voluntary) convergence, which he defines in this way: "The convergence power in a given case is best measured by determining the closest point to which a fine object accurately fixed by both eyes can be brought without either eye diverging." This is the so-called convergence test of, for instance, the R.A.F. It is simply a test for the muscular strength of voluntary squinting, or binocular adduction, very useful for that purpose, but by no means a test for real convergence, as the following figures will show.

The range of normal convergence (or normal fusion movement according to the nomenclature of Elschnig (see also (4), p. 5), is 50 dioptres of prism. The equivalent of this is about 26 degrees,

whereas, according to Duane's measurements, *very low* "convergence" is 32-36 degrees, of which the equivalent, *viz.*, 60-68 dioptres is already considerably higher than normal convergence. Then there is low 36-44 degrees, medium 44-54 degrees, high 54-64 degrees, and very high "convergence" 64-76 degrees. The equivalents in prism dioptres of these degrees are respectively between the very low equivalent 60-68 dioptres, and very high equivalent 120-144 dioptres of prism. These figures unmistakably prove that the so-called convergence, the voluntary kind, is an eye movement of a very different nature from the real convergence which has to do with eye-strain. This latter convergence is tested at a very far point, and is treated with prisms in order to bring it to the normal power of 50 dioptres of prism. Moreover people with astheno-vergence, with a range of convergence power lower than 20, or even 10 dioptres, usually are able to stand the "convergence test" to medium, high and often even very high binocular adduction.

Methodically exciting the patellar reflex, some would perhaps call "exercises." Since, however, it is not physical but physiological work, the physiologist would prefer to call this "treatment." The word exercises should be reserved for gymnastics such as methodical training in ordinary kicking. It is true that this kicking is done with the same group of extensors as are used in the more delicate reflex movement induced by hitting the ligamentum patellae, but there is a difference between them for all that.

The person subjected to the patellar reflex treatment is well aware that he does not act voluntarily. And it is remarkable that, when giving kinetic treatment for astheno-vergence with the battery of prisms, as proposed by me, one meets with nothing but surprise on the part of intelligent patients at the behaviour of the two images. I have personally given kinetic treatment to nearly two thousand people, and am used to patients exclaiming: "Oh, what has happened, there is another image," and "now they have come together again," or "they split, it goes further . . . . now they are one again," or "there is another one, off the screen," or "they come nearer, but will not join," and similar expressions. If these people had used voluntary convergence, they would know it, and not use such expressions. When one asks them, they admit that they cannot help either the splitting or the coming together of the images. Their expressions indicate that they have had a visual experience of something beyond their control, as with the patellar reflex act. Their remarks mean that they have noted the result of a visual reflex, not the performance of a voluntary act.

If patients, during "lessons" given by another technique than mine, get the impression that they converge voluntarily, I fully understand it. The person subjected to the patellar reflex treatment, if he is allowed or even invited to kick during the reflex

movement, will not be conscious of the powerful but more delicate reflex action, but merely of the far coarser movement of kicking.

In regular kinetic treatment some voluntary activity may come later, after three weeks or so. By then the 50 dioptres range has usually been passed. It may happen then that, when the images drift too far apart for involuntary convergence to overcome it alone, voluntary effort may bring them closer together. This does occur, though not in the majority of cases, and I have always avoided drawing the patient's attention to this possibility. The final joining of the two images remains, as always, an involuntary act.

In Williamson-Noble's modification of the technique used and described by me, the procedure has not merely been shortened, but the battery method has been rejected and substituted by treatment with the rotary prisms and the synoptophore. I have warned the readers of both my books against the use of such instruments in this therapy.

Williamson-Noble describes his five lessons very extensively and in great detail because he is out to prove that the convergence elicited is "essentially voluntary and not involuntary in character"[1].

The fact is that after reading his description of the five lessons, I cannot detect any proof as to whether the act of convergence produced by him is voluntary or involuntary. Here applies what I have written in "Eyestrain and Convergence," p. 26, where I describe my experience of the assistance voluntary binocular adduction can give to convergence in difficult circumstances, and state: "These facts are at the bottom of the erroneous impression that there is such a thing as voluntary convergence."

It is regrettable that this more recent and more complete work on the subject[4] has been entirely ignored in the lecture.

The process of treatment as given by me is called long and tedious, and the "job" is considered one for the orthoptic trainer rather than the ophthalmic surgeon. This is a matter not of taste but of outlook. I should never allow such a delicate powerful therapy out of the hands of the person with knowledge of physiology into those of a non-medical person. As it is, we already have grave reasons to object to refracting and eye-mirroring opticians, prescribing glasses to the suffering public. Moreover, Williamson-Noble's five lessons do not do justice to the underlying physiology of the problem.

For the sake of shortness, and, it seems, for economical reasons as well, the kinetic treatment of Williamson-Noble's five lessons is given forcefully, somewhat crudely even. He himself says: "they are usually made worse by the first two lessons, and it is well to warn them of this." Yet, the good results in even his selected 117 cases, treated by his trainer, are high (89 cures, 15 improvements), even seem to him "so unwarrantably high."

My good results, not in selected but in all cases of eyestrain which

come under my care, give a higher percentage. And although I am glad to note that the method, even when applied in so crude a fashion, can give such good results, yet I should like to warn my colleagues not to endanger this proven asset of scientific and practical ophthalmology by haphazard techniques. A rotary prism is an excellent instrument, and so are the synoptiscope and the synoptophore, but I wish to repeat my warning against the use of these instruments in this treatment because of the obvious danger of undue mechanization.

Starting with the work of Donders and his contemporaries, ophthalmology has made astonishing progress, so-much-so that it gives the impression of a rounded off department of medicine, complete at least where its main issues are concerned. And so it is, when one contemplates the technical, optical and surgical aspects. Its achievements may well be sufficient to satisfy the ambition and claim the devotion of many a great medical mind. Nevertheless ophthalmology suffers from onesidedness. It has largely fallen into the hands of predominantly mechanically minded people. Physiology has become the Cinderella.

The enormous physical (surgical and optical) advance fascinates the adepts, and finds recruits almost entirely amongst mechanically minded students of medicine. As a result, new ***physiological*** conceptions are not grasped. Terms of method have replaced terms of function. Thus, when I drew attention to the functional unit whose insufficiency is responsible for most eyestrain, the new conception was overlooked, but the methods evolving out of it were taken up. This is the mechanical outlook. The newly revealed reflex convergence is constantly confused with voluntary adduction, and kinetic treatment, consequently is misnamed "exercises."

Surprise is general that the public are not placidly content with our method of refracting and its result, *viz.*: prescription of the most excellent glasses. Is there irony hidden in the remark[1]: "in some cases it enables patients to discard their glasses, and this, in an age when every one is clamouring for exercises instead of glasses, may be of value?" This shows that we ophthalmologists are no longer ahead of our public. We do not try to help them radically. We should give them functional improvement first, and then, if really necessary, glasses. We show a misplaced contempt of the best, the most desirable part of our practice, those sensible people and intelligent parents who expect understanding of their complaints, but are only offered glasses.

It has been said that heresies were the unpaid debts of the church, and in a press note[7] on my latest monograph, the reviewer has, not unkindly, called me a heretic. He writes: "It was only when the ideas promulgated in generations of textbooks were questioned by the so-called heretics of their day, that progress really became marked."

Let us not overlook the signs of the times. Ophthalmology is losing ground—not, of course, where surgery or physical optics are concerned, but in other essential things. We have not kept faith with the public at large, and this is realized by our thinking professional colleagues.

Tedium is a matter of outlook. Some find physiological obstetrics tedious, and anything but forcipal interference a job for the midwife. Yet this outlook, if general, would bring about high infant mortality and high maternal morbidity.

With the battery of prisms, I have given kinetic treatment to nearly two thousand eyestrain patients. I have never found the procedure tedious, and am looking forward to the opportunity of curing another four thousand. Any ophthalmologist, who is not quite devoid of physiological outlook, can develop this new interest.

The advantages over our present-day chief occupation, refracting, followed by the unavoidable prescription of glasses, are considerable. One can nearly always assure one's patient that he has no anatomical or physical defect or weakness and that he has good strong eyes. That he merely is suffering from a functional, physiological, insufficiency, which can be overcome by a short treatment of a quarter-of-an-hour each day, for a month. This does not preclude the advisability, in selected cases, of prescribing glasses suited to an abnormal refraction as well. During kinetic treatment for asthenovergence, one watches a functional unit of high perceptual level at work, viz.: convergence, the kinetic principle of bi-foveal vision. One learns to rely on it to assert itself. One can count on convergence to give the strikingly good results we have experienced, even with cruder techniques than mine. Another advantage is direct contact with what are usually keen intelligent persons, who appreciate, and try to understand what is being done for them. All this is reflected in the waiting-room, where the gloom of being measured or re-measured for glasses is replaced by a cheerful expectant attitude.

These are not the only advantages. Kinetic therapy for asthenovergence does more than merely cure eyestrain. In 1932 I have drawn attention to one remarkable result, viz.: the improvement in visual acuity in many cases[8]. *The Lancet* at the time reluctantly accepted my claim[9], and called it a "startling statement."[10] I think it throws some light on the obscure problem of amblyopia. It appears that this fact has now been rediscovered[1]—that treatment of eyestrain by my method in a certain number of patients improves the visual acuity. In the paper "Amblyopia"[8] I stated that 25 per cent. of my eyestrain patients have amblyopia due to asthenovergence, and that in this group the average improvement in visual acuity is 50 per cent. Williamson-Noble admits[1] that such results are not uncommon, and have been achieved several times. This is a confirmation of my "startling statement" of 1932, opening up

unexpected therapeutical vistas. This is the improvement which by Williamson-Noble is called ". . . not usually very striking, but such results as 6/9 becoming 6/6 or 6/5 are not uncommon, and have been achieved several times." This is respectively 50 per cent. and nearly 90 per cent. improvement. He also mentions that others have found the same thing[1]. It strikes one that, if after 1932 some more general attention had been paid to this matter, many thousands of keen intelligent people would have benefited meanwhile, considering that in one man's practice alone, some five hundred had their visual acuity improved this way by an average of 50 per cent.

Practical experience of kinetic therapy for astheno-vergence, as well as scientific consideration, leaves no doubt that the act of convergence is a visual reflex act, that is to say an involuntary action.

The anatomical foundation for this group of movements, as already described by me elsewhere[4], is as follows. The unpaired nucleus, the centre of convergence[3], lies across the raphe of the mid-brain. Its situation is between the paired nuclei for the recti interni, and very near the other paired oculomotor and trochlearis nuclei. These paired nuclei, together with the nuclei abducentes, are responsible for all the voluntary eye movements, binocular adduction, or voluntary squint included. Binocular adduction in man, as in the horse for instance, is actuated from the paired nuclei of the recti interni. Convergence however, that phylogenetically young acquirement of the higher mammals, is actuated by its own nucleus through the means of visual reflexes, like accommodation and the pupillary movements. Moreover, the visual reflexes that actuate convergence, can elicit vertical as well as horizontal convergence, as I have found, *inter alia*, in a case of squint caused by traumatic paralysis of the left trochlearis muscle after an air crash, which was treated and cured simply by kinetic treatment for astheno-vergence, modified in view of the circumstances.

Convergence has a unique place in the visual economy, and, I believe, in biology. It is, to my knowledge, the only instance where *movement as such is*—not function merely, but—*part of a sense organ.* Convergence, indeed is essential for the existence of the bi-foveal double eye. It is not just a function of this double eye, but actually part of it. Without convergence the bi-foveal double eye does not exist, but falls apart in two single foveal eyes, each perfect and complete in form and function, but antagonistic to one another, as the case of squint shows. Convergence, therefore, is the kinetic correlate, in the primates, of the binocular fovea, of the semi-decussation of the optic nerves.

The solution of the problem of eyestrain has been looked for in refraction, in accommodation, in phoria, and in eikonia, in the order in which these phenomena were discovered. Refraction is the static, accommodation the kinetic visual condition of the single eye.

Phoria and eikonia are the static visual conditions of the bi-foveal double eye, and convergence it is now clear, is the kinetic visual condition of the human double eye.

In convergence lies the main solution of the great problem of eyestrain. I have reason to believe that squint falls in the same category. The formula for both disorders is to establish the full normal range of convergence. In both, this can be done by kinetic treatment for astheno-vergence. Concomitant squint, I believe, is the consequence of infantile astheno-vergence, eyestrain the consequence of juvenile and adult astheno-vergence. Both disorders are cured by treatment of the astheno-vergence. (I need not here go into detail concerning complications in the case of squint). Traumatic squint can also be cured by kinetic treatment for astheno-vergence, as I found in two rather severe cases, one of which came under my treatment six weeks, the other three years after the accident.

There are many conditions, apart from eyestrain and squint, that benefit greatly by this kinetic treatment. Tennis players may lose some of their ability and endurance through astheno-vergence. These can be restored to full power. Air pilots, who are, or have become, indifferent or bad landers, may gain or re-gain their ability and confidence. Many patients with ophthalmic migraine can have their worst symptoms reduced, and often even eliminated. Even an alarming contraction of the visual fields, obviously the result of astheno-vergence, had its diagnosis confirmed by its prompt and lasting cure by kinetic treatment[4] p. 38. More or less brilliant school children, who had lost their zest for reading or drawing, have become their old selves again after a course of kinetic treatment with the battery.

It would only be sound preventive ophthalmology for every child of school age to have his or her convergence tested, and if below the normal range of Elschnig, 50 dioptres, to have it brought to normal power by kinetic treatment with the battery of prisms.

I have treated a great number of eyestrain patients by my method. Several thousands more of such patients passed through my hands these last fifteen years, but could not, for some reason or other, be treated in the same way, amongst them thousands of children I examined in the school clinic. This emphasizes that the preventive side of present-day ophthalmology is deplorably weak.

These figures of thousands of persons, all in need of kinetic treatment, going through the hands of one ophthalmologist raises the question: what are my colleagues doing about this? It does not appear at all satisfactory that leading ophthalmologists treat a few cases, commend the results, and that we thus merely go on experimenting with this tremendous problem of eyestrain. As a result ophthalmology remains as cramped as ever, and thousands of patients in every ophthalmological practice remain "refraction cases," do not

get further than mechanical alleviation, and drift to opticians. Preventive ophthalmology is again ignored.

Williamson-Noble's selected cases, and the cases that do not respond well to the therapy of glasses, are subjected to a few orthoptic lessons by a trainer. I foresee that these trainers will soon become sufficiently independent to form a trade, like the opticians. They will take the "job" entirely in their own hands. And so this really great opportunity of rising above the status of opticians, and taking part in real preventive medicine will be lost to us.

An increasing number of intelligent people are getting tired of glasses where they are not absolutely necessary. And they are indeed not absolutely necessary in the majority of our refraction cases. This applies to the greatest group, that of hypermetropia, except in a small percentage of excessive ametropia. This applies as well to most of the quarter and half dioptres of astigmatism, provided convergence has a normal range.

At present the public are still looking to us for guidance and help. They are quite prepared to pay for six hours kinetic treatment by a fully qualified medical specialist, just as well as they are prepared to pay for an hour's refracting. If we hand them over, for occasional kinetic treatment to assistants without physiological knowledge, these assistants will soon undertake that work mechanically. I have noticed that opticians are already advertising this so-called orthoptic work. Our profession will be well advised, from the start, to keep this eminently physiological therapy out of the hands of enterprising opticians, and out of the hands of "the ladies who now, with less judgment than enthusiasm, practice orthoptics," as a London authority recently described them to me.

In the schools of ophthalmology, the time and energy spent on teaching the coming generation of ophthalmic surgeons how to refract, is not wasted, considering that refracting cases form such a high percentage of our practice. Yet, where it now has to be admitted that many of these cases are not so much in need of glasses as of treatment for astheno-vergence, the urgent need for teachers who understand, and teach physiological ophthalmology and physiological ophthalmological methods, becomes evident.

Another great problem, so far not properly dealt with, is squint, that terrible handicap in life. In 1929 I instituted an enquiry covering all the primary schools of the Transvaal, comprising about one hundred thousand children. A questionnaire was sent by the Central School Clinic. This questionnaire was accompanied by the necessary means, enabling the teachers of all the schools to examine and report on all the children, who were known, or were supposed to be, squinters. The response was satisfactory—only a few schools did not reply. The result showed that 967 children in the primary schools of the province were reported as squinters, or about 1 per

cent. This high figure is probably an under-estimate. I have seen a similar report from a London district, where the figure was 2·4 per cent.

Twenty years ago, my teacher in ophthalmology made the tentative suggestion that squint might not be a matter of muscles but of brain, but nevertheless for squint he taught us to operate on the eye muscles. I confess to have done such squint operations in the earlier years of my practice only with a bad scientific conscience, thinking of the brain disorder I was operating on!

My first physiologically treated case of squint came into my hands in rather an unexpected manner. In 1932 a girl aged eight years was sent to me by her father, a surgeon, with the intimation that, as I had cured several people of eyestrain, and these people often had discarded their glasses, I might as well cure his daughter, who, for several years now, had been under ophthalmological treatment and had worn glasses for her hypermetropia without any satisfactory effect as to her squint. The girl had normal visual acuity, in either eye 6/6 with and without glasses, a hypermetropia of 1·5 dioptres in both eyes, for which she was wearing the full correction. There was alternating intermittent esotropia. She was often unsquinting when looking at far objects, but not when reading or doing near work, or when she was tired. As, at the time, I had no synoptophore, diploscope or any such adjustable instrument at hand, the only thing to do seemed to treat the case kinetically, starting as high as the patient could easily take, going up and then coming down gradually to zero and negative convergence. This succeeded, even beyond expectation, as in six weeks the patient had full range of positive and negative convergence. She did not squint any more, and has normal binocular and stereoscopic vision. From the beginning of the treatment her glasses were discarded, and no glasses have been worn since.

This technique of squint treatment, adopted on the spur of the moment, I have used since, and developed for the treatment of other and more difficult cases.

One of the most difficult cases was a girl aged eight years, with 6/6 vision in each eye, and an entirely neglected alternate esotropia of 35 degrees. The whole treatment lasted four years, when a cure was effected with full binocular and stereoscopic vision. I decided to take on this case because I wanted to test the verdict of textbooks that such alternating concomitant squints are precluded from ever reaching fusion or stereoscopic vision. This proved to be a fallacy.

The curability of concomitant squint by physiological means is to be beyond doubt. It should be undertaken in the primary school years. Squint should not be patched up by untimely surgical interference, but be treated as the physiological insufficiency it

really is. Physiological treatment of all squint in school children should come within the range of possibility, if ophthalmology will rise to the occasion, and will give the lead in this great cause of preventive medicine.

Summary

Only by accepting the physiological evidence that involuntary convergence is the kinetic principle of human binocular vision, the two great problems, of Eyestrain and of Squint, can be approached correctly.

My kinetic treatment for astheno-vergence does not mean "exercises."

The difference can be understood from the text.

There is a danger of mechanizing kinetic treatment, which will eventually bring it into the hands of unqualified persons.

The paper describes the scope and the results of kinetic treatment.

There is an increasing conviction amongst the profession and the public that too much is made of correction by glasses.

The development of preventive ophthalmology is stunted through the absence of physiological insight in present-day ophthalmology.

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ANNOTATION

Paper Salvage

Our readers will probably have noticed the slight difference in texture and tint of the paper used for printing the Journal since the beginning of this year. Our stock of paper came to an end in December last and like everybody else we have had to make do with what the controller allows us. In after years it may be of interest as dating some of the War years. Deterioration in

quality of paper during war is no new thing. Exactly the same happened in the Napoleonic struggle. Much of the paper used in the earlier years of the last century was very poor in quality and no one now-a-days would dream of reading such a thing as the first edition of Waverley (published 1814), if he could get a later edition.

It behoves us all to contribute as much as we can to the paper salvage campaign. For ourselves we almost tremble to think of the numbers of galleys of back numbers which we have sent to the pulping machine. Old books, old letters, old receipts and paper of every kind are badly needed. It has been rather a wrench to cast out copies of old text-books which we used in the days of our studentship. Some of these were at least forty years out of date but had a sentimental interest to us.

Those who were brought up in Victorian days will be aware of the hoarding propensities of parents in the matter of family and other letters. A great many, but not all, of these are very suitable for salvage. Young hopeful's reiterated appeals from school for a hamper or a new cricket bat or even a modest half-a-crown are not worth keeping, but no one in his senses would destroy letters by eminent hands. If, in going through bundles of old correspondence, one lights upon a letter, for instance, from the poet Wordsworth to one's own grandfather it will be wise to preserve it, for its value may appreciate in post-war times.

ABSTRACTS

MISCELLANEOUS

(1) **Colvin, C. (Orange).—The treatment of trachoma with sulphanilamide.** *Trans. Ophthal. Soc. of Australia*, Vol. II, p. 76, 1940.

(1) **Colvin** describes two cases of trachoma treated by sulphanilamide, 7 grains by mouth thrice daily for 7 days followed by an interval of 7 days and then another course of this treatment. Atropine and mercurochrome 1 per cent. were instilled into the infected eyes 4 hourly, followed by applications of silver nitrate 1 per cent. on alternate days for a week, and then the copper stick 4 times a week. The results substantiate those reported by other observers. Photophobia and lacrimation cease in 24 hours. In cases where pannus has been extensive enough to interfere with vision the vision has improved after 72 hours, in some cases from 6/60 to 6/9 and 6/6. The degree of ptosis is reduced and the follicles become considerably smaller. Infiltration of the cornea clears up

and in some cases the vessels in a sheet of pannus cease to contain blood.

The remarkable feature of the treatment is the rapidity with which improvement occurs as compared with other therapeutic measures. Some authors believe that sulphanilamide acts principally by dealing with secondary infection from pyogenic organisms. The author comments that staphylococci are more commonly found in cultures from the conjunctival sac in cases of trachoma than any other micro-organisms and sometimes the cultures grow no bacterial colonies. Sulphanilamide has relatively little effect on staphylococci. The author is of the opinion that sulphanilamide has a direct action on the trachoma virus. The follicles in the lower lid are the last to disappear.

H. B. STALLARD.

(2) **McGuire, H. H. and McGuire, W. P. (Winchester, Virginia). —Late developments in a case of gyrate atrophy of the choroid and retina.** *Amer. Jl. Ophthal.*, Vol. XXIV, p. 657, 1941.

(2) **McGuire** and **McGuire** report the case of a white male suffering from gyrate atrophy of the choroid and retina whom they have observed for 10 years between the ages of 11 and 21. At first they considered the fundus changes as stationary but subsequent events have proved this disorder to be progressive. The changes in the periphery have extended centrally and have also arisen around the optic disc and spread peripherally, leaving only a narrow band of fundus between these two zones. Night blindness, posterior polar subcapsular cataract, patches of choroidal vascular sclerosis, increased constriction of the visual fields and reduction in visual acuity have occurred. This paper is illustrated by fundus drawings comparing the disease in its early and later stages, and the visual fields.

H. B. STALLARD.

(3) **Sie-Boen-Lian (Batavia).—The course of adult gonococcal ophthalmia and its relationship to the vitamin A content of the blood. (Der Zusammenhang zwischen dem Verlauf der Conjunctivitis gonorrhoica adultorum und dem Vitamin-A-Gehalt des Blutes).** *Ophthalmologica*, Vol. XCIX, p. 496, 1940.

(3) The vitamin A and carotinoid content of the blood was determined in 84 adult patients with gonococcal conjunctivitis with and without corneal complications. The average vitamin A content was higher in simple cases than in those in which the cornea was involved.

In three cases severe corneal ulceration developed after in-patient admission. A much lower vitamin A content was found in the blood of these three patients.

ARNOLD SORSBY.

(4) **Posthumus, R. G. (Haarlem).—Traumatic internal rupture of the lacrymal sac, demonstrated by lipoidol injection and X-ray examination.** *Ophthalmologica*, Vol. XCIX, p. 476, 1940.

(4) **Posthumus** describes a case showing an unusual injury of the lacrymal sac, consisting of the penetration of a wooden splinter in the region of the fossa and leading not only to the obstruction of the lacrymal duct, but also to rupture of the sac and a fistula in the deeper tissues. The case illustrates the value of a lipoidol radiograph.

ARNOLD SORSBY.

BOOK NOTICES

Eye Hazards in Industry: By LOUIS RESNICK. 8vo. pp. XX and 321. With Preface by LEWIS H. CARRIS, and with 33 illustrations. Published for the National Society for the Prevention of Blindness. New York: Columbia University Press. 1941. Price, $3·50.

We learn from the preface that the first handbook on hazards of industrial occupations to be published under the auspices of the National Society for the Prevention of Blindness was in 1917. In 1924 a revised edition by Carris and Resnick came out; and now, after more than a quarter of a century's work, the present book has been issued. By great misfortune Louis Resnick did not live to see his *magnum opus* on the market. He died on March 18, 1941. His contacts with the problem of industrial eye hazards were not those of the easy chair. He visited personally factories, mills, mines, rail-road shops and other plants throughout the United States. His book is a splendid piece of work and ought to be in the hands of all employers of labour as well as ophthalmic surgeons. It is arranged in two parts: first, the problem, secondly, the solution and there are 4 appendices together with bibliography and index.

The opening words of the first chapter bring the reader up against the realities at once. "During the minute it will take you to read this page two American workmen will suffer eye injuries. Every thirty seconds thereafter another workman will clasp his hand, in pain, to one or both eyes, while fellow workers rush to his aid."

The enormous cost of eye injuries, not only to employer, but to the employee and to the community at large is emphasized. It is stated that "eye injuries lead to the loss of more than 53,000,000 man-hours of work yearly. This amounts to the full time of 26,880 men." A conservative estimate of the number of industrial eye accidents occurring in the United States each year is 300,000, or more than 7 per cent. of all industrial accidents. Ninety-eight per

cent. of this loss, human and monetary, is needless; 98 per cent. of all industrial accidents can be prevented.

The chapter on the problem of eye diseases covers mechanical injuries, diseases due to exposure to radiant energy, industrial poisons, poor lighting and other bad working conditions, venereal and other communicable diseases, such as trachoma, etc. Then follow chapters on defective vision and first aid.

In the section on the solution of the problem the methods of elimination by goggles and mechanical guards is explained. A very important chapter is that on eliminating eye hazards through process revision. An instance of this is the rule made by some firms that the tools of every worker are handed in each night for examination and reconditioning before being issued to the workers next morning. In this way the mushroom heads of the chisels are spotted at once, the tool is reconditioned or replaced by a new one and a potent source of danger to the eye removed. In another instance, it used to be the practice for two men to work with pneumatic chisels from each end of a casting bar to chip off the rough excrescences. Each was in danger of getting the flying particles of the other in his eyes. Now a space in the middle of the casting is cleared first and then the men work back to back, thus eliminating most of the danger.

Proper lighting is essential for good work if eye strain is to be avoided, and the need for this is stressed in the next chapter. In the matter of education this must be applied from the top downwards. The employer needs to be educated about eye hazards as well as the worker. "Safety must come from the top down; any plant is as safe as its general manager." "In the first ten years of its safety program the Steel Corporation reduced eye injuries 86 per cent. and many other types of accidental injuries proportionately." "It is specially important that new employees be informed as to any poisonous substances or fumes to which they may be exposed and the precautions they should take."

H. W. Heinrich investigated the circumstances surrounding 75,000 industrial accidents and found that 98 per cent. of all such accidents were preventable, and that 88 per cent. of all industrial accidents could be prevented by proper supervision and administration. Money spent on prevention does not represent out-of-pocket expenses, it is a capital investment and yields a rich rate of interest.

Of the appendices the first gives a self-appraisal form for eye safety in industry for the use of safety engineers and other executives, such as works-foremen concerned with conservation of vision. It is admirable. The second gives a complete schedule of industrial poisons which are hazardous to the eyes and the kind of work in which they are used. It seems to us one of the most valuable of the many valuable features of the book. The third appendix gives minimal standards of illumination for industrial interiors and covers all the usual types of work.

We hope we have said enough to give readers on this side of the Atlantic some idea of the thoroughness with which Dr. Resnick has gone into the subject and the admirable way in which he has completed his investigations and marshalled his facts.

The book is written in a very pleasant style, paper, print and illustrations are all good, and we have thoroughly enjoyed reading it.

A Handbook of Ophthalmology. By HUMPHREY NEAME and F. A. WILLIAMSON-NOBLE. Fourth Edition, 8vo., pp. XVI and 320. London: J. and A. Churchill. 1942. Price 18/-.

The fact that a fourth edition of this handbook has been issued within 15 years of the first issue is proof that it meets the needs of the students and general practitioners for whom it has been written. In our opinion it is one of the best of the shorter text-books on ophthalmology in our language. It is written in an easy style, rarities are kept in the background and nothing of importance to the student has been omitted. The illustrations, many of them in colour, are excellent; and our only criticism is that we think that students, in particular, would have been glad if a coloured illustration of retinal detachment had been added.

The fourth edition has been brought up to date by inclusion of an account of sulphanilamide in the treatment of ophthalmia neonatorum and purulent conjunctivitis of adults, and also with regard to the influence of allergy in phlyctenular lesions and uveitis. Affections of the retina of vascular or toxic origin are now classed under retinopathy rather than retinitis. New work in the aetiology of glaucoma is also mentioned, while the section on tropical ophthalmology, by Colonel Williamson, has been re-written and that on intra-capsular extraction of cataract enlarged.

A word of praise is due to the very complete index.

CORRESPONDENCE

To the Editors of THE BRITISH JOURNAL OF OPHTHALMOLOGY.

DEAR SIRS,—The paper by Dr. Stutterheim published in this issue would seem to call for some comment by me.

I took particular care in my Middlemore lecture to give Dr. Stutterheim the credit he richly deserves for being the pioneer in kinetic treatment of the eyes, and I have therefore no wish to cross swords with him. It is a pity, however, but perhaps understandable, that a pioneer should deprecate any modification in his methods. But the modifications I described would seem to be justified according to the figures quoted by Dr. Stutterheim, namely, that five lessons

by our method sufficed in a large proportion of patients (89 cures, 15 improvements in 117 cases) to bring about the desired result, whereas he, employing his own method has to see the patients for a quarter of an hour every day for a month. Such a procedure is obviously possible in Johannesburg, or it would not have been carried out in two thousand patients, but it would be extremely difficult in London, and probably impossible in most cases.

Many other points might also be commented upon, *e.g.*, whether the work should be done by an orthoptic trainer, or by an ophthalmic surgeon. My own feeling in favour of the orthoptic trainer seems to have been justified by results, and I do not see how anyone who has satisfied the examiners of the Orthoptic Board, can fail to have acquired enough knowledge of ophthalmic physiology to employ intelligently, the methods we have for increasing convergence power. In my own cases, what we aimed at was the voluntary production of diplopia by convergence, because we found that the patients tended to relapse when they had only been taught how to overcome the diplopia produced by prisms base out.

May I conclude, Sirs, by once again congratulating Dr. Stutterheim on his pioneer work, and by stating that our object was to amplify this and not to stultify it.

Yours faithfully,

F. A. WILLIAMSON-NOBLE.

THE EDUCATION OF AN OPHTHALMIC SURGEON

To the Editors of THE BRITISH JOURNAL OF OPHTHALMOLOGY.

DEAR SIRS,—The Education of an Ophthalmic Surgeon, which involves the whole problem of medical education, including therein the curriculum and qualifying and higher examinations, is too large a subject to be dealt with adequately in a letter. Mr. Gayer Morgan has very ably brought forward some points of fundamental importance; and it is possible that, at a time when reformation and reconstruction of medical practice, as well as of other social affairs, are universally acknowledged to be imperative, more success may perhaps be attained than in the past.

When the D.O.M.S. was instituted twenty or more years ago, I was myself afraid that it might be regarded as sufficient evidence of ability to fulfil all the functions of an "ophthalmic surgeon." I therefore strongly urged the institution of a higher conjoint diploma. Realizing that the designation "ophthalmic surgeon" is a misnomer, and that the ophthalmologist should be a physician as well as a

surgeon, I thought that a diploma of the Conjoint Colleges was more logical than any *ad hoc* revision of the F.R.C.S.—though I was prepared to accept this as better than nothing. I think the College of Surgeons was approached by the Ophthalmological Society: in any case it is a fact that Mr. Herbert Fisher, who was then a member of Council of the R.C.S., Mr. Treacher Collins and myself had a conference with the Council and put forward our views. My suggestion was not as strongly supported by my colleagues as I had hoped, and it received little consideration. I then supported an alternative—that the F.R.C.S. final examination should be on the lines of the Edinburgh F.R.C.S., allowing ophthalmology as a special subject. I emphasized that the papers on pathology and general surgical principles should be as stringent as heretofore, but that the examination in surgery, including operative surgery, should be confined to ophthalmology, and that, in addition, there should be a thorough examination in optics and ophthalmic medicine. This suggestion was also turned down. Nothing must be allowed to sully the sanctity of the F.R.C.S. The Council were, however, prepared to make a concession. There should be a F.R.C.S. in ophthalmology, but it should be open only to candidates who already held the ordinary F.R.C.S. This remarkable recommendation was passed, and the F.R.C.S. (Ophthalmology) was instituted. *Mirabile dictu*, ONE candidate took the examination, and passed. I think I am right in saying that this is the only occasion on which the examination has been held; and the F.R.C.S. (Ophthal.) has retired into the limbo of well-deserved obscurity.

Times have changed, and it is possible that the Colleges might now be willing to institute a Conjoint Fellowship in Ophthalmic Medicine and Surgery. It should be an examination of the same status as the F.R.C.S., ensuring that the successful candidate has a thorough knowledge of the fundamental principles of pathology and surgery, as well as of every branch of ophthalmic medicine and surgery.

I regard the education of the "ophthalmic surgeon" as essentially a post-graduate subject. There are ophthalmic conditions which every general practitioner ought to be taught to recognize and treat. Undergraduate teaching and examination for qualification as a doctor should be limited to them. *In the present state of the curriculum* undergraduate teaching in ophthalmology is a heart-breaking task. I have expressed my views on the medical curriculum, etc. in a paper on "Medical Education of the Future" elsewhere (*Lancet*, March 2, 1940).

Yours truly,

J. HERBERT PARSONS.

THE DIAGNOSTIC SIGNIFICANCE OF RETROBULBAR NEURITIS

To the Editors of THE BRITISH JOURNAL OF OPHTHALMOLOGY.

DEAR SIRS,—If no abler pen than mine has been moved to comment upon an article by Rosa Ford in your March number on the Diagnostic Significance of Retrobulbar Neuritis, may I be allowed the ever ungracious task of the critic? There appears to be a noticeable disproportion between the evidence and the conclusions put forward in her paper, which surely calls for some comment.

It is generally acknowledged to be unwise to draw conclusions from an isolated case history, and I would suggest that in this instance even the conclusions themselves are not the most attractive which could be put forward.

We are asked to believe that an attack of retrobulbar neuritis originated from a closed nasal sinusitis of which there were neither symptoms nor signs. ("All search for a cause proved fruitless"). We are further asked to believe that eight years later this same insidious and invisible sinusitis gave rise to rheumatoid arthritis and recurrent iritis. After eight years of unhindered gestation there are still no symptoms of sinusitis, and no recorded signs; in other words, no evidence of sinusitis preceding interference with the nasal cavities. It is hardly surprising to learn that the application of argyrol and glycerine to the nasal passages provoked a flow of mucus; it is distressing, but not remarkable, to learn that after three weeks the discharge contained lumps of muco-pus. I am told that this experience is not without precedent among those who attack the nose on general principles alone.

Evidence as to the cause of the retrobulbar neuritis in this case is (I venture to suggest), entirely lacking. There is no more evidence to suggest that it was due to an undetectable nasal sinusitis than there is to suggest that it is due to an undetectable disseminated sclerosis; but the balance of probablity, from common experience, is surely overwhelmingly in favour of the latter. It is well known that retrobulbar neuritis is not uncommonly followed in later life by manifestations of disseminated sclerosis; it is a common experience to find no certain signs of disorder of the central nervous system at the time of an attack of retrobulbar neuritis in early adult life, and they may not develop for twenty years; but can one dare to say with certainty that the case reported—who is not yet forty years of age, and was but twenty-eight at the time of the latest record of her condition—may not yet develop the disease? Is contraction of the visual fields in a young woman of twenty to be taken as evidence of closed nasal sinusitis as against disseminated sclerosis?

With regard to the later history of her progress, surely rheumatoid

arthritis and intractable recurrent iridocyclitis are not uncommonly associated? Admittedly both conditions are often of obscure origin; but the proof that they were due to nasal sinusitis in her case is sadly lacking. There is not even any satisfactory evidence of a pre-existing nasal sinusitis at all. In fact, so far from suggesting that there was a previous causative sinusitis, it seems more probable that both conditions may have been relieved by the development of the sinusitis. Little as we know about the origin and relief of either rheumatoid arthritis or recurrent iridocyclitis, it is at least a recognised method of treatment for both deliberately to induce fever and leucocytosis. The result of such therapy, by protein shock or other methods, may be strikingly beneficial. May not the establishment of a mucopurulent nasal sinusitis in 1931 have acted in a similar way?

Opinions differ widely as to the significance of the rôle of focal sepsis (and tuberculosis) in the causation of ophthalmic diseases. We are all familiar with those refreshing, uncommon cases where the removal of a focus of sepsis is quickly followed by the relief of some stubborn and apparently unrelated disease, perhaps under such conditions as to provide strong evidence that we have been dealing with cause and effect; but these cases should surely be looked upon as supplying evidence to support a theory, not as the foundations of a gospel. They call for caution as well as enthusiasm: it is easy to forget the dictum of Ambrose Pare, "I dressed him, and God cured him."

No useful purpose is served by pressing analogy too far. It can only end in the mischievous result that our eyes are blinded to the limitations of our knowledge of aetiology, and our minds closed against any new interpretation of the facts. It may well be that just as the discovery of vitamins threw a flood of light on the aetiology of much that was previously obscure, some new advance of medical knowledge may teach us where to look for the cause of diseases whose origins are still shrouded in darkness. To draw conclusions from the slender evidence provided by this single case seems to me to establish a veritable outpost of medical credulity. I salute the pioneering spirit for which it stands, but I would suggest that it were better demolished, at least until a suitable number of cases, with adequate controls and convincing evidence, can be brought forward.

"There is more faith in honest doubt,
"As Tennyson has pointed out,
"Than in these nasty creeds!

Yours faithfully,

ALLAN H. BRIGGS.

20, MINSTER YARD,
LINCOLN.

OBITUARY

CHARLES HOWARD USHER

THE recent death of Charles Howard Usher, late of Aberdeen, was briefly recorded in our last issue. Born in 1865, he was the 4th son of Thomas Usher of Edinburgh, and nephew of Andrew Usher, who was one of Edinburgh's benefactors. He was educated at Cambridge University and St. Thomas's Hospital, where he came under the influence of Edward Nettleship, which determined his life's work in ophthalmology. Qualifying M.B., B.Ch.(Cantab.), in 1891 he took the F.R.C.S.(Edin.) in 1894. At Aberdeen he was ophthalmic surgeon and later consulting ophthalmic surgeon to the Royal Infirmary, and ophthalmic surgeon to the Royal Aberdeen Hospital for Sick Children. In early days he had been ophthalmic house surgeon at St. Thomas's, and chief clinical assistant at Moorfields.

Usher joined the Ophthalmological Society of the United Kingdom in 1894, served on the council early in the present century, was vice-president, and president from 1927-1928. In 1927 he was awarded the Edward Nettleship prize and in 1935 he delivered the Bowman Lecture.

He was the Aberdeen representative on the general committee of this journal since our foundation 25 years ago; and he was a frequent contributor of papers to our pages.

Dr. W. Clark Souter writes:—

The passing of Dr. Charles Howard Usher, at the ripe age of seventy-seven, is an event in the medical history of Aberdeen that cannot be allowed to go without some attempt at adequate notice, for a man of his strong personality and his high scientific attainments does not come along every day. Dr. Usher took his medical degrees at Cambridge and at St. Thomas's Hospital, London, where he fell under the spell of that other great scientist of ophthalmology, Edward Nettleship, whilst acting as his house surgeon. This friendship lasted up to Nettleship's death and had the most profound influence on Dr. Usher's life and work.

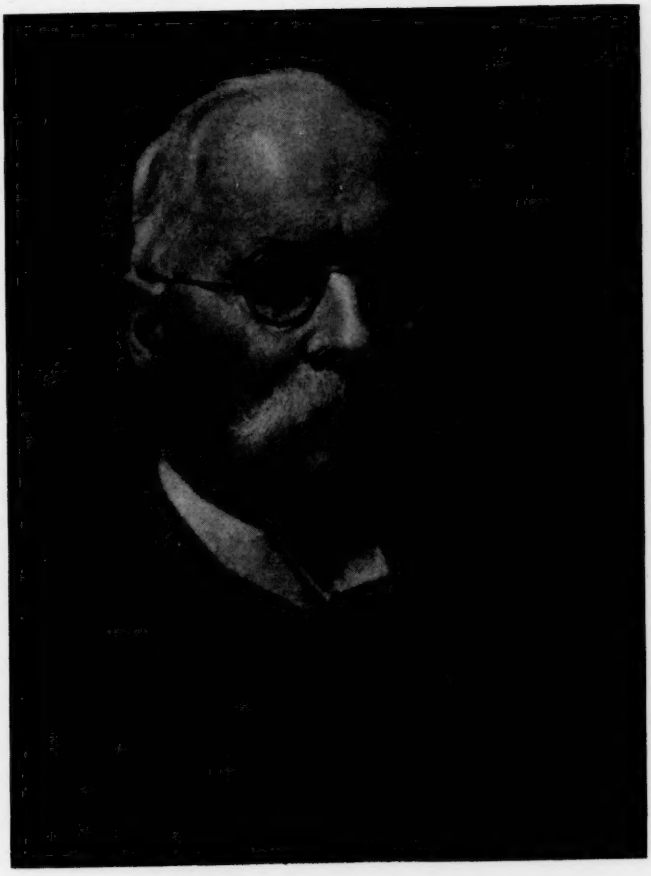
After a short spell in Edinburgh the young ophthalmic surgeon applied for the post of Ophthalmic Surgeon to the Aberdeen Royal Infirmary and was appointed. He started in 1895 that long and much appreciated service that lasted till 1926, being interrupted by one year when he had a trip round the world and by two years of military service in Salonika. His high sense of professional etiquette, his passion for truth, his painstaking note-taking, and his obvious close attention to all his work, fired with a rare zeal and astounding energy, soon led to a fuller and fuller appreciation of his worth and

work. In addition to his hospital duties at the Infirmary, the Dispensary and the Children's Hospital he found time for a busy consulting practice, and time for researches of various kinds, many of which adorn the literature of his speciality and some of which have become classical. Honours came his way in good measure. In 1927 he was elected President of the Ophthalmological Society of the United Kingdom, and was awarded the Edward Nettleship Prize, while, in 1935, he delivered the Bowman Lecture—a very high honour. This was followed by election to an honorary fellowship of the Royal Society of Medicine.

In association with Karl Pearson and Mr. Nettleship he produced "A Monograph on Albinism in Man," several volumes of the Drapers' Company Research Memoirs, 1911-1913. It is not too much to say that the bulk of the work and many of the best illustrations are his work. Some very interesting facts and pictures were obtained by Dr. Usher in his world tour when he visited the Solomon Islands, New Guinea and Japan. Many of his contributions are of a highly technical character, especially those dealing with the inheritance of eye affections not only in man but in some of the lower animals. All bear evidence of the most profound care and attention to detail so that if infinite capacity for taking pains defines genius then he deserves that title. He abhorred publicity and took no part in public affairs but devoted his life to the scientific advancement of his life's study. Yet he found time for relaxation and was reputed to be very handy with rod and gun, whilst he was a partaker of the practical joys of chamber music. Behind a somewhat stern exterior could be found by his intimate friends a most generous and entertaining personality, a shrewd observer of men and affairs, richly endowed with the fruits of his experience in his wide travels and full of interest—truly a remarkable man.

Miss Julia Bell writes:—

I once told him of a family in a remote spot in the West of Scotland saying that it would be of interest to know what sort of stock they came from, and what had happened to them during the last 12 years or so. He gave his holiday to the job, following them up in homes and hospitals, schools and institutions all over the country side. He examined the eyes of 100 individuals, interviewed parents, school medical officers, nurses, midwives and medical superintendents, and handed me a pedigree reaching right across my room, including records of some 600 individuals, just as if he were handing me a daily newspaper. As he went away he said "I hope you are not in a great hurry, there is going to be a new baby in August, and I shall have to go back and examine and photograph it." He was always like that—I tried to get a history of Huntington's Chorea brought up-to-date by doctors in Aberdeen who



CHARLES HOWARD USHER

had been concerned, but they failed to run the family to earth and were sure I would not succeed in contacting them. So I wrote to Usher, the result, with a greatly enlarged pedigree was quickly in my hands.

It is surely of significance that so shy and reserved a man should be so successful in this sort of work, he told me that he had never once had difficulty in getting information about family histories. It will be long before we find another Usher.

When I was working on the Nettleship volume he used to read my M.S., perhaps 200 or so pages of handwriting, before it went to press to ensure that I had not fallen into errors through lack of clinical experience. It was a great service to ask and it re-assured me and gave me confidence as nothing else could. I don't think he ever suggested a modification, except in the matter of spelling! I well remember his kindly little notes.

Sir John Parsons writes:—

The death of Charles Usher, following so soon on that of Percy Flemming, recalls a brilliant period in the history of Moorfields Eye Hospital, when both were clinical assistants, the former to Mr. Nettleship, the latter to Sir John Tweedy. Nettleship and Waren Tay had been clinical assistants to Jonathan Hutchinson, and were indeed responsible for much of the material which Hutchinson incorporated in his work on syphilis and his ophthalmological papers. Nettleship attracted a large but select band of disciples to his clinic, men who were sufficiently keen to appreciate his methods and teaching, and to submit to his somewhat severe discipline and criticism. Many of these—Lawford, Holmes Spicer and Usher, for example—carried on the Nettleship tradition, which was concerned as much with the science as with the art of ophthalmology. It was Usher who pre-eminently devoted himself to the furtherance and elaboration of Nettleship's own line of research, as is shown particularly in his work on heredity, embodied in his Bowman Lecture and in his monographs with Miss Julia Bell. His enthusiasm was unbounded, and no trouble was too great to run to earth the members of a colour-blind family, no matter how far away from his home in Aberdeen. Indeed, he went much farther afield, as for instance when he took the opportunity during a visit to the South Seas while recuperating from an illness to charter a native craft in order to search out and photograph some albino Polynesians. Moreover, in the interests of research he at one time bred stoats in his back yard in Bon Accord Square. So highly did his friends regard his work that he was proposed as a candidate for the Fellowship of the Royal Society, an honour which he would have appreciated above all others. It is, however, very difficult for a lone worker

to attain this coveted honour in competition with those whose lives are devoted to academic science. Even after he had had warnings of angina pectoris he made a long trip to Canada and visited many places in the wilds which could only be reached by aeroplane.

Usher was a very reserved man—so much so that he gave the impression of resenting any approach to intimacy. There was a strong streak of Puritanism in his character, and his unwavering adherence to what he considered right sometimes revealed a lack of *savoir faire* which alienated his colleagues. Thus, he refused to accept the honorary degree of LL.D. of Aberdeen University because it had previously been conferred on one whom he deemed unworthy of the honour. Yet to those who succeeded in penetrating his armour and gaining his confidence he was a staunch friend and a delightful companion. He was a keen fisherman and a good ornithologist. He was passionately fond of music, and found much enjoyment in playing the 'cello in a string quartette which met weekly at his house.

LIEUT.-COLONEL H. HERBERT

IT is with great regret that we announce the death at Worthing, on March 19, 1942, of Lieut.-Colonel Herbert Herbert, I.M.S. (ret.). He was aged 77 years and had been living in retirement of late. As an ophthalmic surgeon Herbert achieved very much more than a purely British reputation. His work at Bombay, both in the clinical and pathological field, was of outstanding value and was conducted in a truly scientific spirit. His description of the "pits," since known as Herbert's pits in the cornea of trachomatous patients was the first of its kind. In this, as in much else he was a pioneer; and it should be emphasized that he did all the microscopical work on his cases in his spare time. The other subject on which Herbert was brought into prominence was of course glaucoma. In varying parts of the world surgeons were engaged on devising some operation for types of glaucoma, which it was agreed, did not always do well on the classical iridectomy of von Graefe. Thus Lagrange, in France, Freeland Fergus, in Glasgow, Holth, in Scandinavia, Herbert, in Bombay and Elliot, in Madras were all at work on this subject in the early years of the present century. It was a great pity that Herbert's description of his first, or wedge-shaped, sclerotomy was so involved as to be difficult to understand from the verbal account; and we do not think that it ever found much support in England. But his later, or trap-door, sclerotomy has been extensively used and has a permanent place in our operative procedures in selected cases. Besides his work on glaucoma he wrote a good deal on cataract.

Herbert joined the Ophthalmological Society in 1897 and served a term as vice-president. He qualified from Leeds in 1886 and took the F.R.C.S. (Eng.) in 1891. At Bombay he was ophthalmic surgeon to the Sir C. J. Ophthalmic Hospital from 1895 to 1907. He was also a Fellow of Bombay University.

On retirement Herbert settled at Nottingham and was surgeon, and later consulting surgeon, to the Nottingham and Midland Eye Infirmary. About twenty years ago he moved to Worthing where he was ophthalmic surgeon to the Worthing Hospital and Pathologist to the Sussex Eye Hospital. He contributed many papers to the Transactions of the Ophthalmological Society, to the Ophthalmic Review and to our columns.

Herbert was a quiet, friendly man, tenacious of his own opinions but never ultra-dogmatic or self-seeking. His work was done in the scientific interests of his subject; he fought well for his beliefs but was always a courteous and kindly opponent.

NOTES

Death

We regret to record the death of George William Kendall, of Stoke Newington, and of 11, Devonshire Place, on February 16, 1942. His education was received in Ireland where he qualified M.B., B.Ch. in 1893 and where he proceeded M.D. in 1895.

He held honorary appointments at Hitchin and St. Albans and was a regular member of the Oxford Ophthalmological Congress and the Ophthalmic Section of the Royal Society of Medicine. Early in his career he had worked at Moorfields as Chief Clinical Assistant and during the 1914-18 War he was an ophthalmic specialist to the Army with the rank of Captain, R.A.M.C. Later he served as ophthalmic surgeon to the Ministry of Pensions. Kendall was interested in professional organization and was a member of the City Division of the British Medical Association, of which he had been President in 1929. He contributed some papers to the Proceedings of the Section of Ophthalmology of the Royal Society of Medicine. As oculist to the Hertfordshire County Council Schools and to the London Teachers Association he knew well the problems connected with vision, both of scholars and teachers.

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Honour

Group Captain P. C. Livingston has been elected F.R.C.S.(Eng.), as a member of twenty years' standing.

White Oak Hospital, Swanley.

THE following are the admissions recorded for 1941.

Phlyctenular Ophthalmia	77
Blepharitis	44
Interstitial Keratitis	8
Trachoma	8
Acute Conjunctivitis	8
Chronic Conjunctivitis	13
Miscellaneous	5
	163

There were also admitted 134 babies and 100 nursing mothers to the ophthalmia neonatorum block (transferred as a war measure from St. Margaret's Hospital). The hospital provided hospitality to 24 nursery babies and 12 measles contact.

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Ophthalmological Society of the United Kingdom. Annual Congress

THE dates previously announced for the Congress, viz. May 29, 30, are confirmed. The subjects for discussion are :—(1) The value of Sulphonamides in Ophthalmology, to be opened by Major G. I. Scott and Mr. Arnold Sorsby: (2) The rôle of Vitamins in Ophthalmology, to be opened by Dr. Raymond Greene and Mr. F. A. Williamson-Noble. There will be no official annual dinner and members who intend to read papers or to take part in the discussions are asked to inform Mr. Frank W. Law as soon as possible.

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Irish Ophthalmological Society

THE meeting of the Irish Ophthalmological Society will be held on May 7, 8, and 9, 1942.

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Special Notice

WE are asked by the Ministry of Information to state that the fact that goods made of raw materials in short supply owing to war conditions are advertised in this journal should not be taken as an indication that they are necessarily available for export.

FUTURE ARRANGEMENTS

1942

May 7, 8, 9.—Irish Ophthalmological Society, at Dublin.
May 29, 30.—Ophthalmological Society of the United Kingdom, Annual Congress in London.
July 2, 3, 1942.—Oxford Ophthalmological Congress, at Oxford.